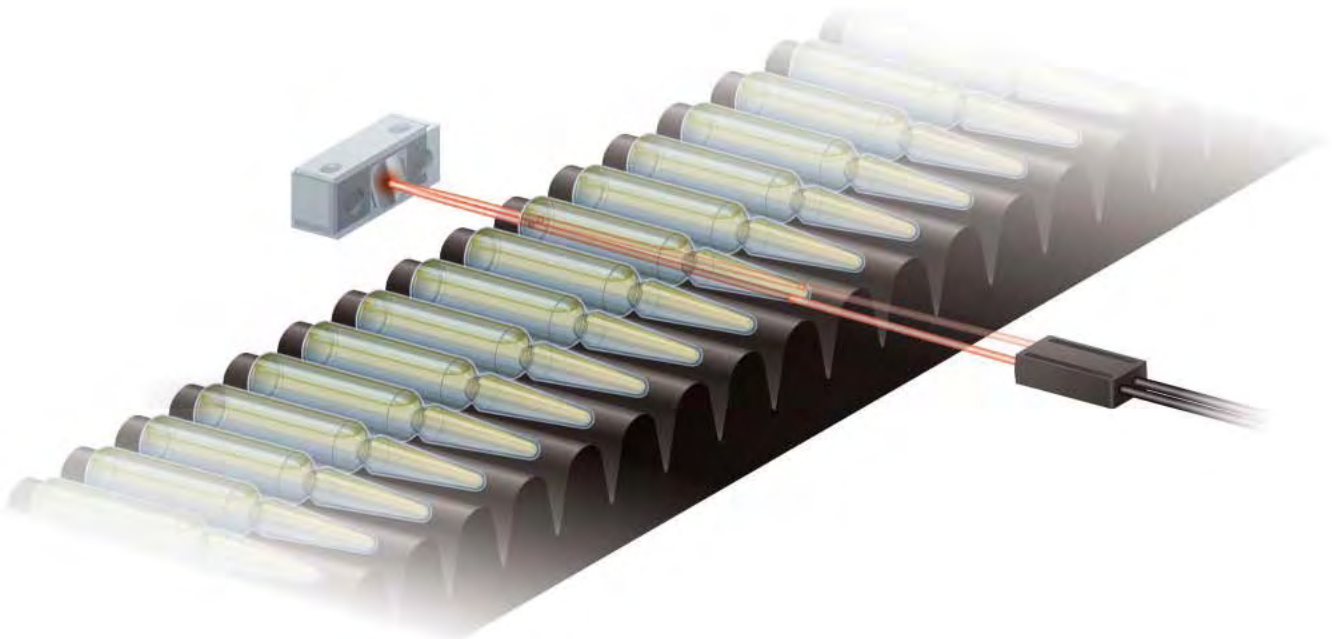


NARROW BEAM RETROREFLECTIVE TYPE FIBER

New **FR-KZ21/KZ21E**

Ideal for sensing transparent objects!

Stable sensing of transparent objects such as transparent sheets on transparent mounts and transparent tubes

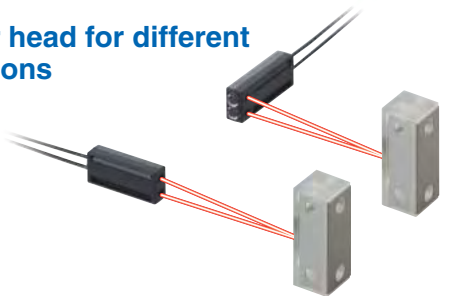


Stable sensing of transparent objects is possible

A unique optical system gives excellent performance in sensing transparent objects at close ranges. Uses an exclusive reflector (RF-003) for stable sensing of transparent objects such as transparent sheets on transparent mounts and transparent tubes.

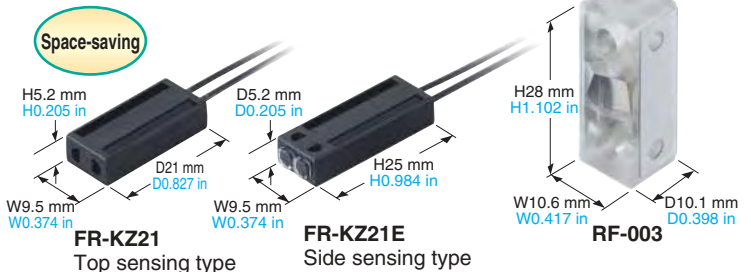
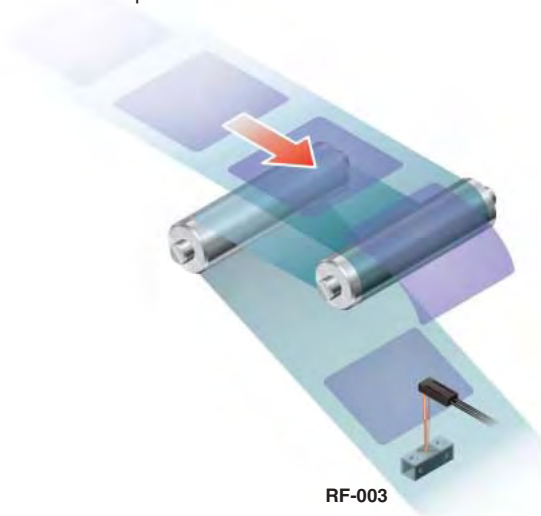
Two types of fiber head for different installation directions

Two types of fiber head are available: a Top sensing type (FR-KZ21) and a Side sensing type (FR-KZ21E). Whichever type best suits the installation conditions can be selected.



Ultra-compact fiber head & compact reflector

The fiber head size is ultra compact at W9.5×H5.2×D21 mm W0.374×H0.205×D0.827 in (Side sensing type: W9.5×H25×D5.2 mm W0.374×H0.984×D0.205 in). The reflector is also a compact W10.6×H28×D10.1 mm W0.417×H1.102×D0.398 in so that it very space efficient.



SPECIFICATIONS

Type		Top sensing type	Side sensing type
Item	Model No.	FR-KZ21	FR-KZ21E
Applicable amplifiers (Note 1)			
FX-301/305/311/411			
Sensing range (RF-003)			
200 mm 7.874 in (FX-301/305/311/411)(Note 2)			
Allowable bending radius			
R10 mm R0.394 in or more			
Fiber cable length			
2 m 6.562 ft free cut			
Ambient temperature			
-40 to +60 °C -40 to +140 °F, Strage: -40 to +60 °C -40 to +140 °F (No dew condensation or icing allowed)			
Ambient humidity			
35 to 85 %RH, Strage: 35 to 85 %RH			
Material	Fiber cable	Fiber core: Acrylic, Sheath: Polyethylene	Fiber core: Acrylic, Sheath: Polyethylene
	Fiber head	Enclosure: ABS	Enclosure: ABS, Prism: Acrylic
	Reflector	Reflector: Norbornene resin Mounting bracket: Stainless steel (SUS)	
Weight		Net weight: 4.4 g approx., Gross weight: 54 g approx.	Net weight: 4.7 g approx., Gross weight: 54 g approx.
Accessories		FX-AT4 (Fiber attachment for ϕ 1 mm ϕ 0.039 in fiber): 1 set FX-CT2 (Fiber cutter): 1 pc. MS-FD-2 (Fiber mounting bracket): 1 pc., RF-003 (Reflector): 1 pc.	

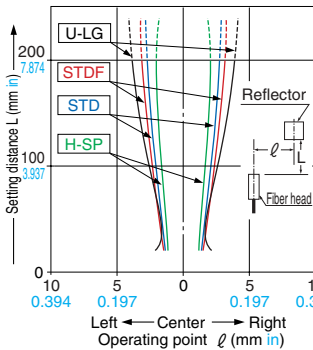
Notes: 1) Refer to the sensor general catalog 2003-2004, catalog of each amplifier or SUNX website (<http://www.sunx.co.jp>) for details about the applicable amplifier.
2) The 'sensing range' means the possible setting range for the reflector. The fiber can detect an object less than 20 mm 0.787 in away. However, if setting the fiber to detect objects passing within 0 to 20 mm 0 to 0.787 in from the fiber head, unstable detection may result.

SENSING CHARACTERISTICS (TYPICAL)

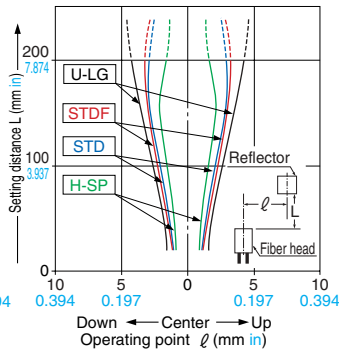
FR-KZ21

Parallel deviation

• Horizontal direction



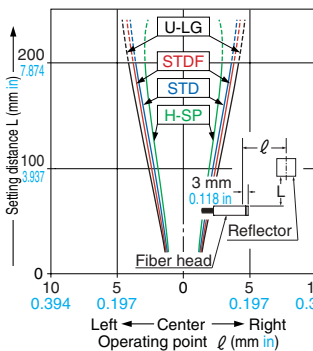
• Vertical direction



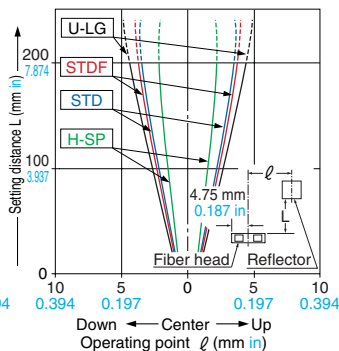
FR-KZ21E

Parallel deviation

• Horizontal direction



• Vertical direction



All information is subject to change without prior notice.

PRECAUTIONS FOR PROPOSER USE



- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet regulations and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Mounting

If not using the attached mounting bracket

- If not using the attached mounting bracket, mount using set screws (cup point, M3 or less). In such cases, use a tightening torque of 0.1 N.m or less.

If using the attached mounting bracket

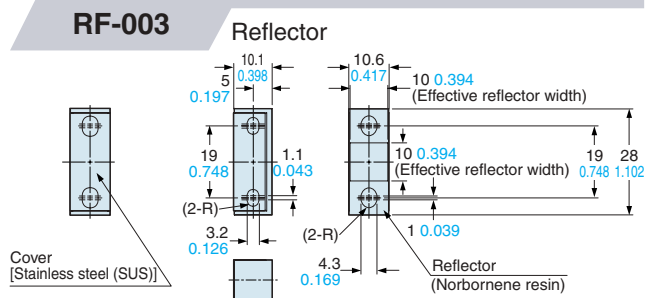
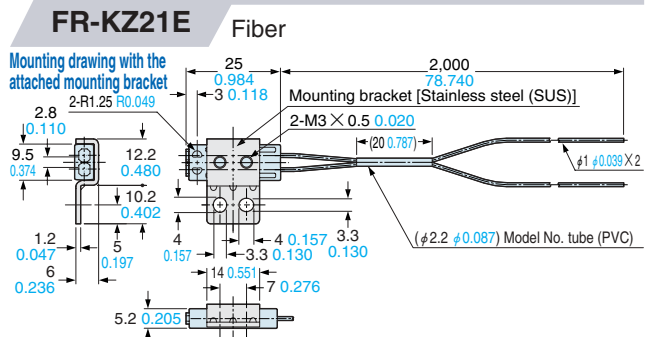
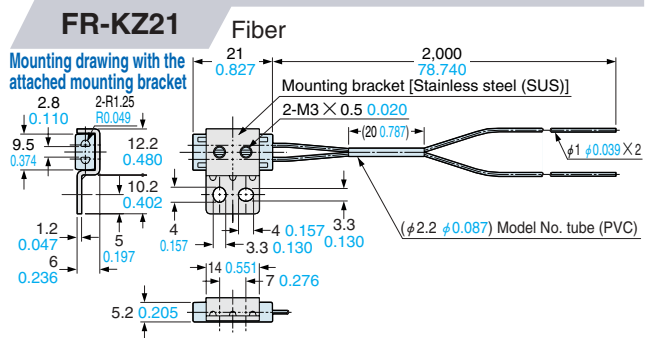
- Even if not using together with set screws, the fiber head can still be secured. In such cases, use a tightening torque of 0.3 N.m or less.
- Note that if using together with set screws, the mounting brackets may become bent if excessive tightening torque is used. In such cases, use a tightening torque of 0.05 N.m or less.

Caution

- This product has an extremely narrow opening, and it may not receive light under certain setup conditions. Take careful note of any beam axis offset and tilt to ensure that the center of the fiber head is aligned with the center of the reflector.

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.co.jp/>





WAFER MAPPING FIBER

New

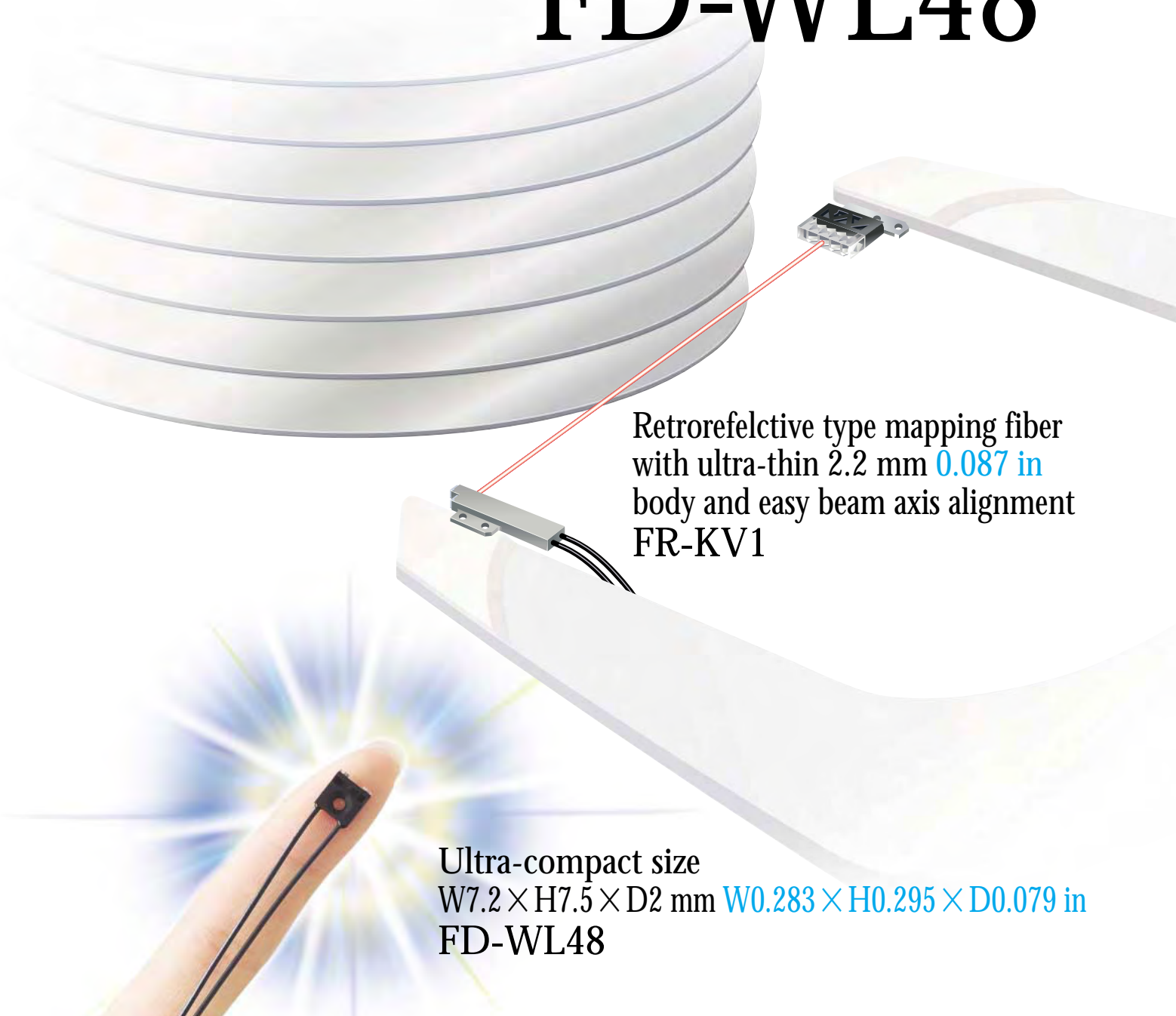
FR-KV1 Retroreflective Type SERIES

FT-KV1 Thru-beam Type SERIES

ULTRA-COMPACT · FIXED-FOCUS REFLECTIVE FIBER

New

FD-WL48



Retroreflective type mapping fiber with ultra-thin 2.2 mm **0.087 in** body and easy beam axis alignment
FR-KV1

Ultra-compact size
W7.2 × H7.5 × D2 mm **W0.283 × H0.295 × D0.079 in**
FD-WL48

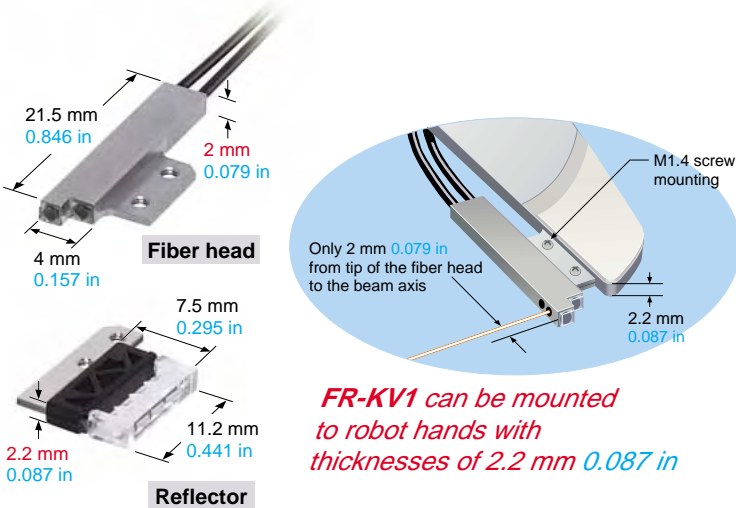
Wafer mapping fiber FR/FT-KV1

NEW Concept !

Retroreflective type mapping fiber with ultra-thin 2.2 mm 0.087 in body and easy beam axis alignment

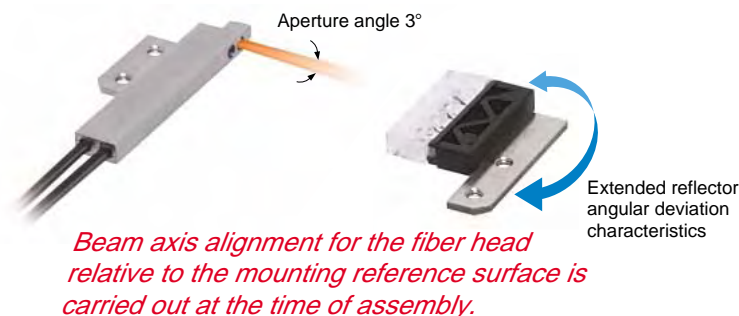
Ultra-thin retroreflective type reduces construction work Retroreflective type

2.0 mm 0.079 in fiber head and an ultra-thin 2.2 mm 0.087 in reflector allow these to be mounted even in thin robot hands. Furthermore, because they are retroreflective type fibers, the amount of wiring needed can be reduced, and the robot hands require less processing and so can be kept strength.



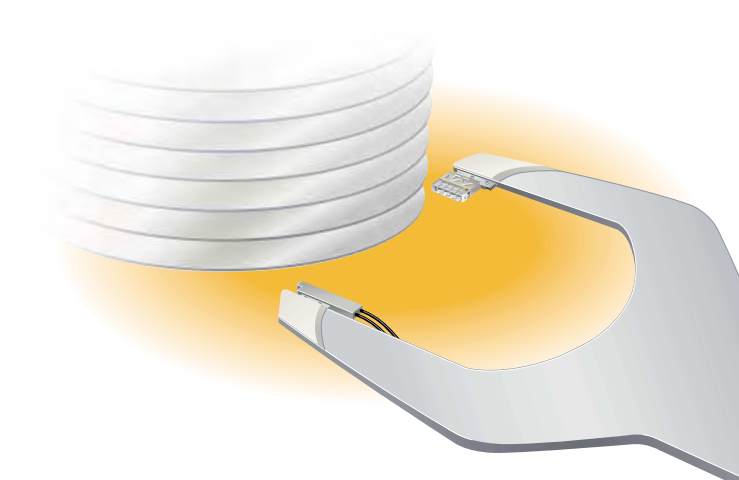
Ultra-narrow beams and extended angular deviation characteristics Retroreflective type

A retroreflective type fiber is used, so that an aperture angle of less than 3° produces an ultra-narrow beam, but still with extended angular deviation characteristics compared to thru-beam types. This allows stronger curvatures in robot hands and reduces the work required for beam axis alignment.



Heat-resistant type available FR-H10-KV1

Resistant to temperatures of +105 °C +221 °F, so that the robots can be used with confidence for wafer transportation immediately after heat processing.



Thru-beam type fiber FT-KV1 / FT-H10-KV1

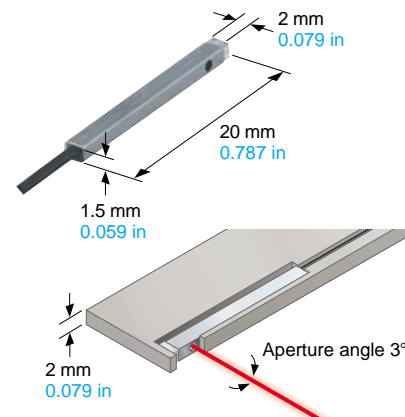
New

Heat-resistant type available FT-H10-KV1

Resistant to temperatures of +105 °C +221 °F, so that it can be used with confidence for wafer transportation immediately after heat processing.

Ultra-compact size

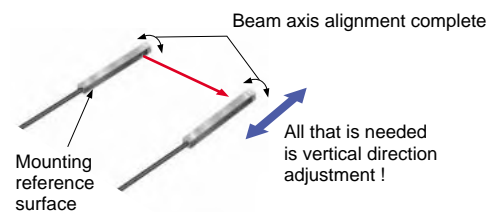
The ultra-compact size of W2 × H1.5 × D20 mm W0.079 × H0.059 × D0.787 in means that mounting is possible even in places such as robot hands where space is limited.



With the FT(-H10)-KV1, the fiber can be embedded into a plate with a thickness of 2 mm 0.079 in.

Reduces work required for beam axis alignment

In order to reduce the amount of work required for mounting, beam axis alignment for the fiber head relative to the mounting reference surface is carried out at the time of assembly.



Extended sensing range

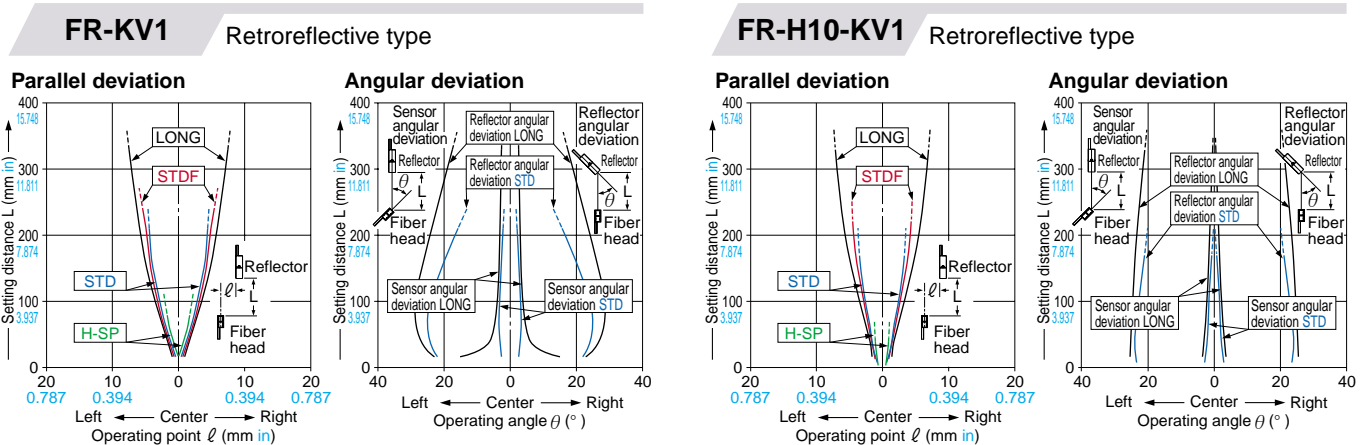
A sensing range of 250 mm 9.843 in (in STD mode) allows easy mapping of 300 mm 11.811 in wafers.

SPECIFICATIONS

Item	Designation Model No.	Retroreflective type wafer mapping fiber		Thru-beam type wafer mapping fiber		Fixed-focus reflective type fiber FD-WL48
		FR-KV1	FR-H10-KV1	FT-KV1	FT-H10-KV1	
Applicable amplifiers (Note 1)		FX-301(P)(-HS), FX-305(P), FX-311(P)				
Sensing range (Note 2, 3)	U-LG	370 mm 14.567 in		600 mm 23.622 in		0.5 to 8.5 mm 0.020 to 0.335 in
	LONG	330 mm 12.992 in		500 mm 19.685 in		0.5 to 7.5 mm 0.020 to 0.295 in
	STDF	240 mm 9.449 in	220 mm 8.661 in	300 mm 11.811 in		1 to 6.5 mm 0.039 to 0.256 in
	STD	210 mm 8.268 in	170 mm 6.693 in	250 mm 9.843 in		1 to 5.5 mm 0.039 to 0.217 in
	FAST	170 mm 6.693 in	130 mm 5.118 in	180 mm 7.087 in		1 to 5 mm 0.039 to 0.197 in
	S-D	90 mm 3.543 in	45 mm 1.772 in	100 mm 3.937 in		—
	H-SP	80 mm 3.150 in	40 mm 1.575 in	90 mm 3.543 in		—
Min. sensing object (Note 3, 4)		ϕ 0.12 mm ϕ0.005 in opaque object		ϕ 0.02 mm ϕ0.001 in opaque object		ϕ 0.3 mm ϕ0.012 in copper wire (at maximum sensitivity)
Allowable bending radius		R10 mm R0.394 in or more		R10 mm R0.394 in or more		R1 mm R0.039 in or more
Fiber cable length		2 m 6.562 ft free cut		2 m 6.562 ft free cut		1 m 3.281 ft free cut
Ambient temperature		-40 to +60 °C -40 to +140 °F Strage: -40 to +60 °C -40 to +140 °F	-40 to +105 °C -40 to +221 °F Strage: -40 to +105 °C -40 to +221 °F (Note 5)	-40 to +60 °C -40 to +140 °F Strage: -40 to +60 °C -40 to +140 °F	-40 to +105 °C -40 to +221 °F Strage: -40 to +105 °C -40 to +221 °F (Note 5)	-20 to +60 °C -4 to +140 °F Strage: -20 to +60 °C -4 to +140 °F
Ambient humidity		35 to 85 % RH, Strage: 35 to 85 % RH (No dew condensation or icing allowed)				
Material	Fiber cable	Fiber core: Acrylic Sheath: Polyethylene	Fiber core: Acrylic Sheath: Polypropylene	Fiber core: Acrylic Sheath: Polyethylene	Fiber core: Acrylic Sheath: Polypropylene	Fiber core: Acrylic Sheath: Polyethylene
	Fiber head	End bracket: Stainless steel (SUS303), Lens: Polycarbonate				Case, Prism: Polycarbonate
Net weight		50 g approx.		40 g approx.		2 g approx.
Accessories		FX-AT4 (Fiber attachment for ϕ 1 mm ϕ0.039 in fiber): 1 set, Reflector: 1 pc. FX-CT2 (Fiber cutter): 1 pc., M1.4 (length 1.6 mm 0.063 in) SUS mounting screw: 4 pcs.		FX-AT4 (Fiber attachment for ϕ 1 mm ϕ0.039 in fiber): 1 set FX-CT2 (Fiber cutter): 1 pc.		

- Notes: 1) Refer to the catalog of each amplifier or sunx website (<http://www.sunx.co.jp>) for details about the applicable amplifier.
 2) The **FX-301(P)(-HS)** is not equipped with U-LG / STDF modes. The sensing range for the **FX-301(P)(-HS)** in H-SP mode also varies from that given, so contact our office for details.
 The **FX-305(P)** is not equipped with a S-D mode. The **FX-311(P)** is not equipped with U-LG / STDF / FAST / H-SP modes.
 3) The sensing ranges and min. sensing object sizes for the retroreflective type fibers are the values when using the exclusive reflectors. Furthermore, the distance between the fiber head and the reflector should be set to 15 mm **0.591 in** or more.
 The sensing range for the fixed-focus reflective type fiber is specified for white non-glossy paper (100 × 100 mm **3.937 × 3.937 in**).
 4) The minimum sensing object size for the retroreflective and the thru-beam type fibers is the value in optimum condition. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
 The minimum sensing object size for the fixed-focus reflective type fiber is the value at maximum sensitivity. Note that the corresponding setting distance is different from the rated sensing distance.
 5) The ambient temperatures are the values for dry conditions. The ambient temperatures will vary for environments with high humidity. The ambient temperature for environments with high relative humidity of 85 % is -40 to +50 °C **-40 to +122 °F**.

SENSING CHARACTERISTICS (TYPICAL)

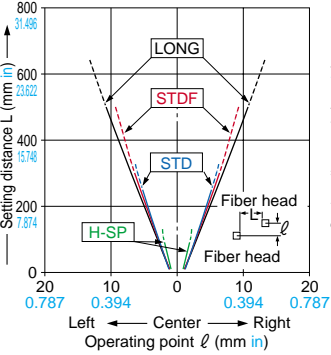


SENSING CHARACTERISTICS (TYPICAL)

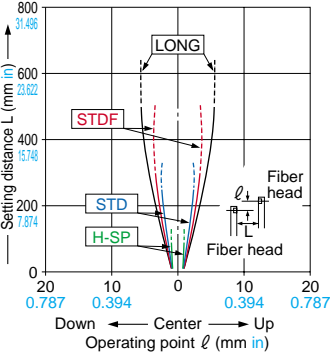
FT-KV1 Thru-beam type

Parallel deviation

• Horizontal direction



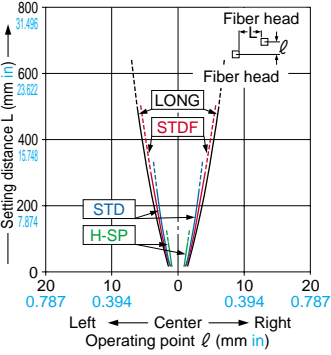
• Vertical direction



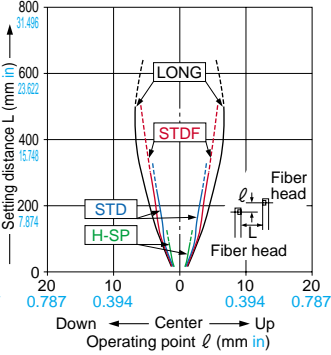
FT-H10-KV1 Thru-beam type

Parallel deviation

• Horizontal direction

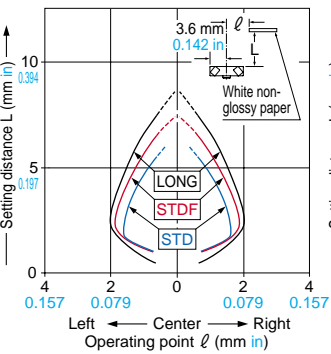


• Vertical direction

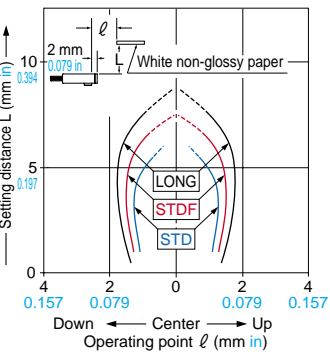


FD-WL48

• Horizontal direction



• Vertical direction



PRECAUTIONS FOR PROPER USE



- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws or standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

Mounting

- Take care that, since the aperture angle of this product is very narrow, the beam may not be received depending upon the setting.

FT-(H10)-KV1

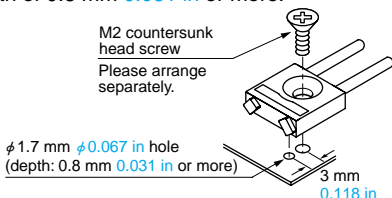
- Mount the fiber head by using M3 or less set screws (cup point). The tightening torque should be 0.19 N·m or less.

FR-(H10)-KV1

- Mount the fiber head by using the attached screws. The tightening torque should be 0.14 N·m or less. If the fiber head is mounted in places subject to vibrations or shocks, use a screw-locking adhesive, etc.

FD-WL48

- Mount the fiber head by using M2 countersunk head screws (please arrange separately). The tightening torque should be 0.15 N·m or less. In addition, the hole for inserting the boss on the bottom should have a diameter of 1.7 mm 0.067 in and a depth of 0.8 mm 0.031 in or more.



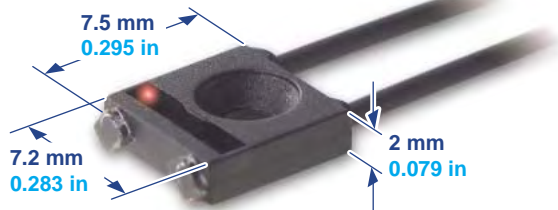
Others

- Do not use the fiber at places having intense vibrations, as this can cause malfunction.
- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.
- If the sensing surface gets dirty, wipe dirt or stains from the sensing faces with a soft cloth moistened with water. (Do not use organic solvents.)
- Do not expose the fiber to any organic solvents.
- Do not use the fiber head surface in places where it may come in direct contact with water. A water drop on the fiber head surface deteriorates the sensing.
- Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.
- Do not apply excessive tensile force to the fiber cable. (The tensile force should be 5.0 N or less.)
- Take care that the fiber is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- Avoid areas prone to vapor or dust as well as corrosive gas environments. Do not expose the fiber directly to water or chemicals.

Ultra compact·fixed-focus reflective fiber **FD-WL48**

Even more compact

W7.2 × H7.5 × D2 mm **W0.283 × H0.295 × D0.079 in** ultra-compact size



Ultra-compact size saves space

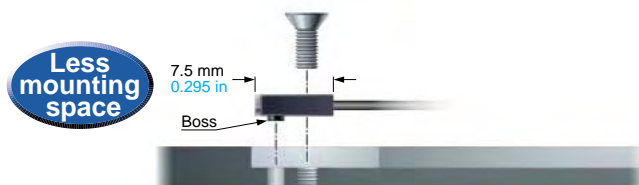
The ultra-compact size of **W7.2 × H7.5 × D2 mm** **W0.283 × H0.295 × D0.079 in** holds a fixed-focus reflective optical system. These fiber heads can now be mounted in locations and devices that were previously impossible because of a lack of space. As a result, an even wider range of applications is now available.

• Mounting in handling arms



Single boss mounting saves space

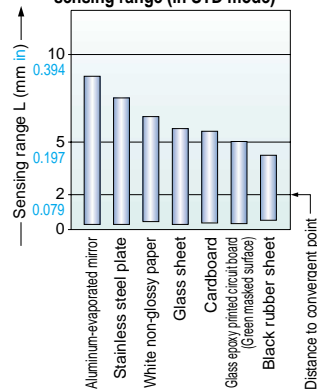
The fiber head is mounted by attaching one boss to the back and using a single M2 countersunk head screw, so that the fiber heads can be more compact and take up less mounting space.



Stable sensing regardless of sensing object color and material

The fixed-focus reflective optical system means that sensing is almost completely unaffected by the color and material of the sensing objects. In addition, stable sensing is possible with very little effect from the background.

Correlation between material and sensing range (in STD mode)




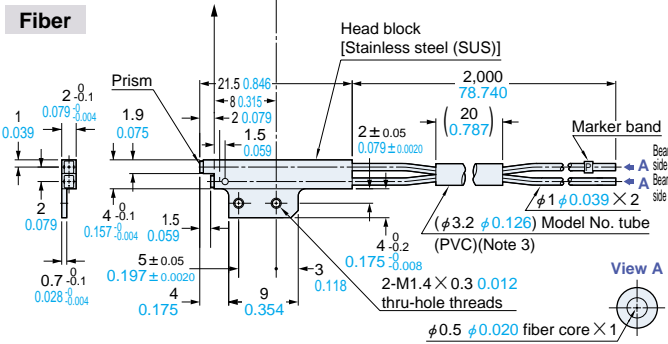
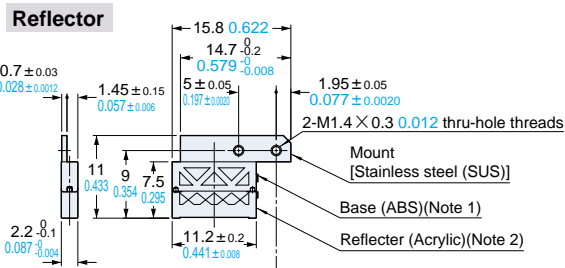
Minimum bending radius **R1 mm** **R0.039 in**

Sharp bending fibers are used, so that the fiber cables can be bent to a bending radius of 1 mm **0.039 in**.



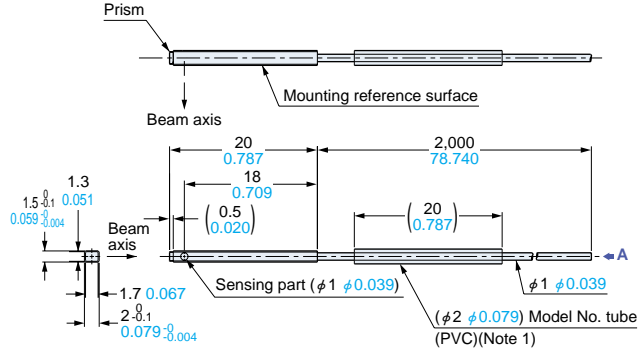
No light attenuation even when bent to this extent!

FR-KV1
FR-H10-KV1  Free-cut **With FX-AT4**

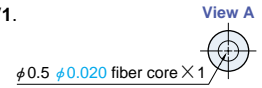



- Notes: 1) The material used for the **FR-H10-KV1** reflector is polycarbonate.
2) The material used for the **FR-H10-KV1** reflector is norbornene plastic.
3) Not equipped with the **FR-H10-KV1**.

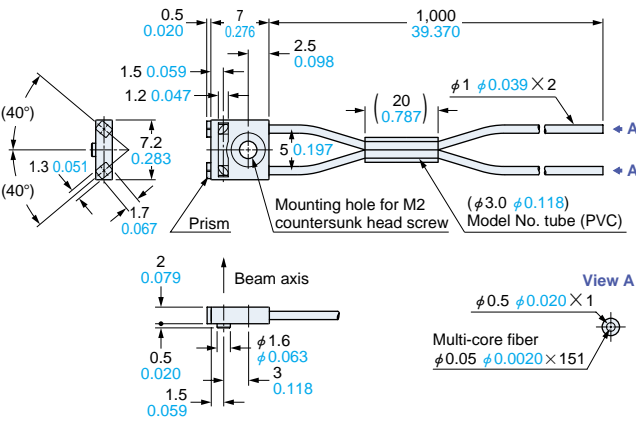
FT-KV1
FT-H10-KV1  Free-cut **With FX-AT4**



Note: Not equipped with the **FT-H10-KV1**.



FD-WL48  Free-cut **With FX-AT4**



All information is subject to change without prior notice.





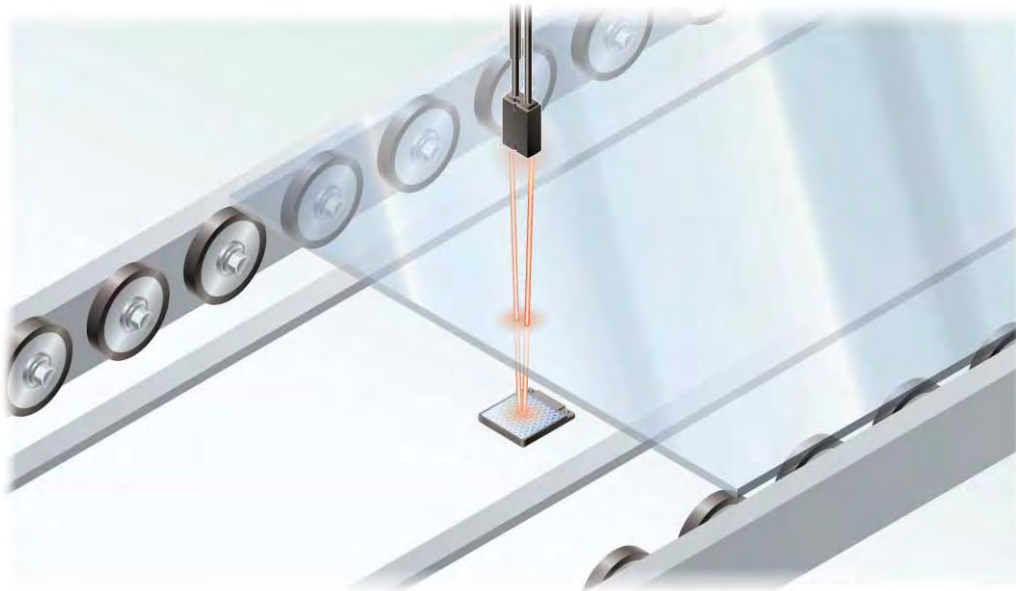
RETROREFLECTIVE WITH POLARIZING FILTERS FIBER

New

FR-WKZ11

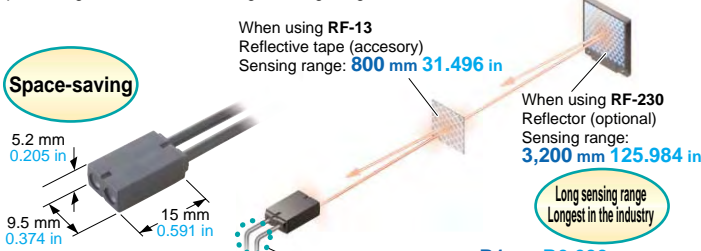
Stable sensing of transparent objects

Even glass substrates can be accurately detected.



Compact head and long sensing range

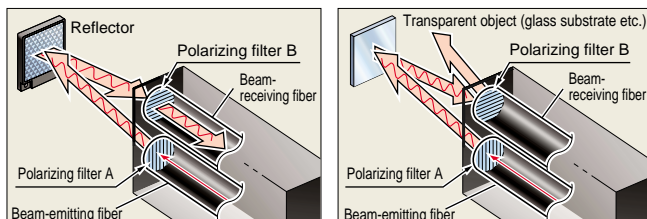
This fiber has a compact head of W9.5×H5.2×D15 mm W0.374×H0.205×D0.591 in. Equipped with sharp bending fibers (Allowable bending radius: R1 mm R0.039 in) making it space efficient. It is a retroreflective type with a polarizing filters that has a long sensing range of 3,200 mm 125.984 in.



※Sensing range values determined with the amplifier in LONG mode. Unstable detection may result if setting the fiber to detect objects passing within 0 to 100 mm 0 to 3.937 in from the fiber head.

Unaffected by surface reflection from transparent objects

FR-WKZ11 has a built-in polarizing filters in its tip, so that it is unaffected by surface reflection from transparent objects and specular objects directly in front of it.

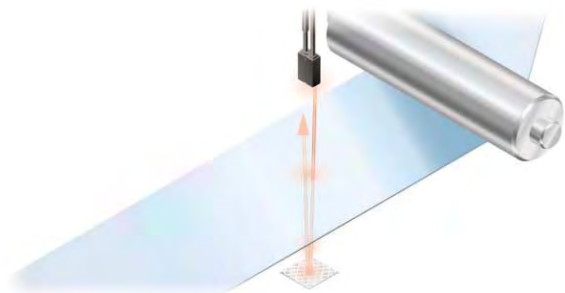


Light passing through polarizing filter A is changed the direction of polarization by a reflector and polarizing filter B only lets in beam whose wavelengths run horizontally.

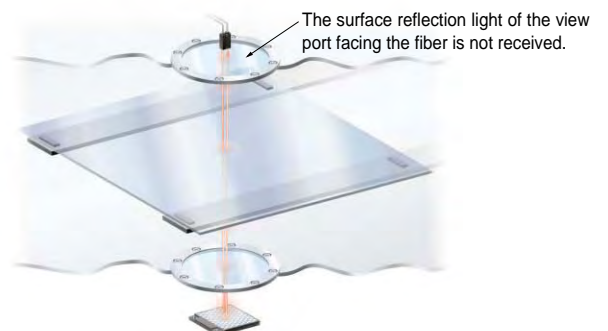
Because the reflected light from the transparent object returns oscillating in the same direction as the incident light, it does not pass through polarizing filter B.

Gives stable detection of transparent objects

Because it's a retroreflective type, light passes through transparent objects twice, so differences in light amount can be easily picked up and glass substrate and transparent films can be detected with good stability.



Because stable sensing is made possible at a long range, transparent objects (glass substrates and the like) can be detected through a view port.



SPECIFICATIONS

Type	Retroreflective with polarizing filters fiber
Item Model No.	FR-WKZ11
Applicable amplifiers (Note 1)	FX-301/302/303/311 series
Sensing range (RF-13) (Note 2, 3)	100 to 800 mm 3.937 to 31.496 in (LONG), 100 to 570 mm 3.937 to 22.441 in (STD) 100 to 500 mm 3.937 to 19.685 in (FAST)(Note 4), 100 to 350 mm 3.937 to 13.780 in (S-D)
Sensing range when detecting a glass substrate (reference)(Note 3, 5)	100 to 280 mm 3.937 to 11.024 in (RF-13), 100 to 1,000 mm 3.937 to 39.370 in (RF-230)
Repeatability	Along sensing axis: 6 mm 0.236 in or less Perpendicular to sensing axis: 1.2 mm 0.047 in or less
Min. sensing object (Note 6)	φ0.3 mm φ0.012 in opaque object
Allowable bending radius	R1 mm R0.039 in or more
Fiber cable length	2 m 6.562 ft free cut
Ambient temperature	- 25 to + 55 °C - 13 to + 131 °F (No dew condensation or icing allowed), Strage: - 25 to + 55 °C - 13 to + 131 °F
Ambient humidity (Note 7)	35 to 85 %RH, Strage: 35 to 85 %RH
Material	Fiber core: Acrylic, Sheath: Polyethylene
Fiber head	Enclosure: Polycarbonate, Lens: Crown glass (BK7)
Weight	15 g Approx.
Accessories	FX-AT3 (Fiber attachment for φ2.2 mm φ0.087 in fiber): 1 set FX-CT2 (Fiber cutter): 1 pc., MS-FD-2 (Fiber mounting bracket) RF-13 (Reflective tape): 1 pc.

- Notes: 1) Refer to the sensor general catalog 2003-2004, catalog of each amplifier (FX-301/311 series) or dedicated homepage for fiber sensor (<http://www.fiber-sensor.com>) for details about the applicable amplifier.
- 2) The sensing ranges are the values for red LED type amplifier (excluding FX-303).
- 3) The sensing range and sensing range when detecting a glass substrate are the possible setting range for the reflector or the reflective tape. The fiber can detect an object less than 100 mm **3.937 in** away. However, if setting the fiber to detect objects passing within 0 to 100 mm **0 to 3.937 in** from the fiber head, unstable detection may result.
- 4) FX-311(P) does not have a FAST mode.
- 5) The sensing range when detecting a glass substrate are the values for red LED type amplifier (excluding FX-303) at STD mode. The sensing range is specified for t=0.7 mm **0.028 in** glass substrate for LCD.
- 6) The minimum sensing object value is the value for red LED type under optimum conditions. The optimum condition is the condition when the sensitivity is set so that the sensing output just changes to light incident operation in the object absent condition.
- 7) If using the fiber with a reflector (RF-230/220/210), changes in the ambient humidity level may lead to fluctuations in the amount of incident light. Exercise caution when using the fiber set to low differences in light amount. If using the fiber in an area prone to significant changes in ambient humidity level, we recommend the RF-13.

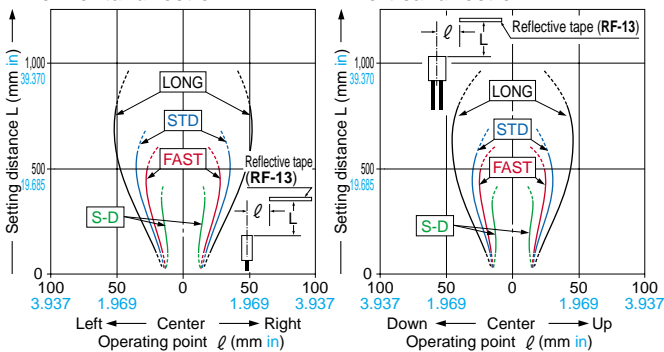
Sensing range when using a reflector (optional)(mm in)

RF-230	100 to 3,200 3.937 to 125.984 (LONG), 100 to 2,000 3.937 to 78.740 (STD) 100 to 1,600 3.937 to 62.992 (FAST), 100 to 1,000 3.937 to 39.370 (S-D)
RF-220	100 to 2,400 3.937 to 94.488 (LONG), 100 to 1,300 3.937 to 51.181 (STD) 100 to 1,000 3.937 to 39.370 (FAST), 100 to 600 3.937 to 23.622 (S-D)
RF-210	100 to 1,100 3.937 to 43.307 (LONG), 100 to 700 3.937 to 27.559 (STD) 100 to 550 3.937 to 21.654 (FAST), 100 to 300 3.937 to 11.811 (S-D)

SENSING CHARACTERISTICS (TYPICAL)

Parallel deviation

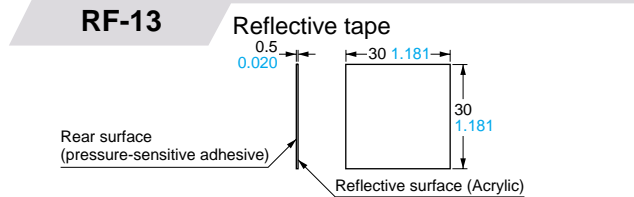
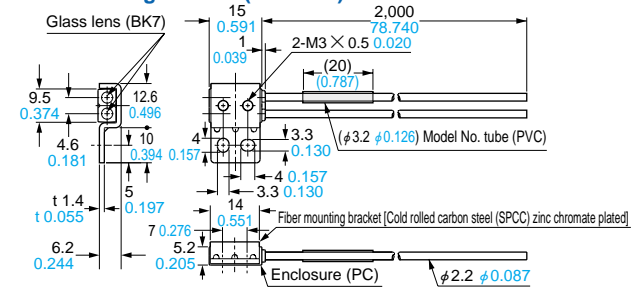
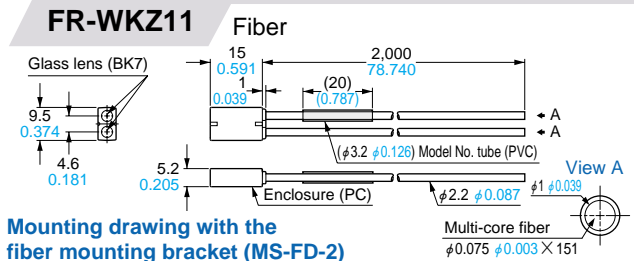
• Horizontal direction



All information is subject to change without prior notice.

DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.co.jp/>



PRECAUTIONS FOR PROPOSER USE

This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

Mounting

- If not using the attached mounting bracket**
 - Use M3 or less set screws (cup point), and affix the head within 15 mm **0.591 in** from the tip of the fiber head. Do not exceed a torque of 0.3 N·m when tightening.
- If using the attached mounting bracket**
 - The head can be affixed even without using the set screws together.
 - If using the set screws together, use M3 set screws (cup point) to affix and do not exceed a torque of 0.05 N·m when tightening.

Cautions

- Keep the fiber head surface intact. If it is scratched or spoiled, the detectability will deteriorate.
- If the sensing surface gets dirty, wipe dirt or stains from the sensing faces with a soft cloth. (Do not use organic solvents.)
- Ensure that any strong extraneous light is not incident on the receiving face of the fiber head.
- Do not apply excessive tensile force to the fiber cable. (The tensile force should be **20 N or less**.)
- Take care that the fiber is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- Avoid areas prone to vapor or dust as well as corrosive gas environments. Do not expose the sensor directly to water or chemicals.
- Take care that the fiber does not come in direct contact with organic solvents, such as, thinner, etc.

